Name: ______________________ Date: ______________

Polynomial Operations SOLUTION (version 145)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -4x^5 - x^4 - 5x^2 + 7x - 9$$

$$q(x) = 8x^5 - 6x^4 + 5x^3 - 2x^2 + 1$$

Express the sum of $p(x) + q(x)$ in standard form.

Get “unsimplified” forms. Then find $p(x) + q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-4)x^5 + (-1)x^4 + (0)x^3 + (-5)x^2 + (7)x^1 + (-9)x^0 \\ q(x) &= (8)x^5 + (-6)x^4 + (5)x^3 + (-2)x^2 + (0)x^1 + (1)x^0 \\ p(x) + q(x) &= (4)x^5 + (-7)x^4 + (5)x^3 + (-7)x^2 + (7)x^1 + (-8)x^0 \\ p(x) + q(x) &= 4x^5 - 7x^4 + 5x^3 - 7x^2 + 7x - 8 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -6x^2 + 3x - 2$$

$$b(x) = -3x + 6$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-6x^2$	$3x$	-2
$-3x$	$18x^3$	$-9x^2$	$6x$
6	$-36x^2$	$18x$	-12

$$a(x) \cdot b(x) = 18x^3 - 9x^2 - 36x^2 + 6x + 18x - 12$$

Combine like terms.

$$a(x) \cdot b(x) = 18x^3 - 45x^2 + 24x - 12$$

3. Express $(x + 1)^5$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal’s triangle.

$$x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$$

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4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= 2x^3 + 17x^2 + 11x + 21 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 2 & 17 & 11 & 21 \\ -8 & & -16 & -8 & -24 \\ \hline & 2 & 1 & 3 & -3 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = 2x^2 + x + 3 + \frac{-3}{x+8}$$

In other words, $h(x) = 2x^2 + x + 3$ and the remainder is $R = -3$.

5. Let polynomial $f(x)$ still be defined as $f(x) = 2x^3 + 17x^2 + 11x + 21$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (2)\cdot(-8)^3 \ + \ (17)\cdot(-8)^2 \ + \ (11)\cdot(-8) \ + \ (21) \\ &= (2)\cdot(-512) \ + \ (17)\cdot(64) \ + \ (11)\cdot(-8) \ + \ (21) \\ &= (-1024) \ + \ (1088) \ + \ (-88) \ + \ (21) \\ &= -3 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = -3$.